PATENT SPECIFICATION 1,075,404

DRAWINGS ATTACHED.

1,075,404

Date of Application and filing Complete Specification:
June 18, 1964. No. 25314/64.

Application made in Japan (No. 46002) on June 19, 1963.

Complete Specification Published: July 12, 1967.

Index at Acceptance:—A2 A2; A5 B(4, 6); B2 L26H; B8 S(3D, 5, 10B).

Int. Cl.:—B 05 c /A 61 k, B 65 g.

COMPLETE SPECIFICATION.

Electrostatic Tablet Coating Apparatus.

We, TANABE SEIYAKU CO. LTD., a corporation duly organized under the laws of Japan, of 21, Doshoh-machi 3-chome, Higashi-ku, Osaka, Japan, and ZENJI TAKASONO, of Japanese nationality, of 333, Minami Senzoku-cho, Ota-ku, Tokyo, Japan, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to electrostatic coating apparatus as applied to oral medicaments, and has particular reference to apparatus which incorporates a novel device for inverting tablets to be coated. It has long been known to coat tablets, pills and capsules in order to protect the ingredients of such oral medicaments against the atmosphere, to mask their objectionable taste and odour, to control their disintegration time in gastric juices, or to improve their appearance. Equipment heretofore employed for the coating of tablets has, in most cases, involved a revolving pan in which a predetermined amount of tablets are stirred in contact with a coating material, for example a sugar coat, which may be added either mechanically or manually and dried with air. This coating operation is repeated as many times as required for the capacity of each coating pan to produce a desired quantity of coated tablets. It usually takes about 5 to 10 minutes to finish the coating per layer of each tablet to a thickness ranging from 0.5mm to 1mm.

The above conventional coating process has the drawbacks that it takes considerable time and labour. Further variations are inevitable in the thickness of the coated layer, resulting in pin holes in the surface of the tablet. An excess of coating solution is apt to cover the tablets which results in longer disintegration time of the dose, so that skilled labour is required in such batch coating operations.

A number of sugar coating processes and apparatus have been introduced, but none of them has satisfactorily solved the above noted problems inherent in the pan-coating operation.

More recently there has been introduced electrostatic means for coating oral medicaments by using an atomizer whereby finely divided particles of a coating solution may be deposited onto tablets in a high potential electrostatic field. This method can substantially eliminate the above noted difficulties of the conventional pan-coating processes. However, no devices have been heretofore known for enabling a quantity of tablets to be coated on both faces substantially in a single operating step and at a high rate.

Accordingly, it is the main aim of this invention to provide novel means for reversing the tablets while travelling so that they may be coated on both faces in a continuous flow process.

The features of the invention will become apparent from the following description taken in conjunction with the accompanying drawings which illustrate a preferred form of coating apparatus in accordance with the invention. In these drawings:

Fig. 1 is a schematic layout of the coating apparatus;

Fig. 2 is a cross-sectional side view of a tablet inverting mechanism incorporated in the apparatus; and

Fig. 3 is a cross-sectional view taken on the line I—I in Fig. 2.

Reference to Fig. 1 shows the coating apparatus as comprising a first or upper stage belt conveyor 10 adapted to transport a number of tablets 100, a second or lower

stage belt conveyor 10^1 similarly adapted to transfer the tablets 100 which have been coated, a hopper 12 mounted above the first stage conveyor and adapted to supply uncoated tablets in a uniformly spaced-apart relation onto the first stage conveyor, a first stage coating sprayer or atomizer 13 adapted to coat one side of each tablet and a second stage coating sprayer or atomizer 13^1 to coat the other side of the tablet, a first stage infra-red heater or other suitable means 14 for drying the coated tablets on the first stage conveyor, a second stage infra-red heater or other suitable means 14^1 for drying the coated tablets on the second stage conveyor, and a rotating tablet-inverting drum or rotor 15 interposed between two adjacent pulleys 17, 17^1 and adapted to reverse the half-coated tablets, the rotating tablet-inverting drum or rotor being provided with a cylindrical housing having a conduit or tablet passageway 16 between the upper and lower conveyors 10, 10^1.

The first and second belt conveyors 10, 10^1 are endlessly passed about their respective pair of pulleys 17, 17^1 which may be driven synchronously by a motor (not illustrated) at the same peripheral speed and in the same direction, and are further passed under and over a suitable number of guide rollers 18, 18^1.

Indicated at 19, 19^1 are high voltage grids connected to a suitable high voltage source carrying about 70 to 100 kilovolts, and adapted to cooperate with the corresponding sprayers or atomizers 13, 13^1 in applying a finely divided coating solution comprising a coating substrate or composition to tablets, pills and capsules. Since such electrostatic coating process *per se* is well known in the art and is no part of this invention, no further discussion in this connection will be served. The dryer 14 or 14^1 may be of an infra-red heating type or any other suitable types capable of drying the coated tablet without marring its smooth surface condition.

The apparatus shown in the drawings further comprises baths 20 and 20^1 containing a suitable liquid for washing the conveyor belts to remove the coating substrate or composition deposited thereon during the coating of the tablets, for which purpose there are provided brush rolls 21 and 21^1 to contact the belts in motion. The washing baths may conveniently have inlet tubes 22 and 22^1 connected, through valves 23 and 23^1, to one side of the baths for introducing fresh washing liquid when necessary, and may further have drain pipes 24 and 24^1 connected, through valves 25 and 25^1, to the bottoms thereof.

Thus, it will be appreciated that the apparatus has two substantially identical stages for the coating operation, the first stage being slightly higher in level than the second so that the tablet-inverting drum 15 may be situated intermediate between the pulley 17 on the first stage and the pulley 17^1 on the second stage as shown more clearly in Fig. 2.

The hopper 12 is provided with suitable means (not shown) for permitting a substantial quantity of tablets to be aligned and equally spaced apart when dropped onto the first stage belt conveyor, so that individual tablets may be coated uniformly while passing under the atomizer 13.

Turning to Fig. 2 and Fig. 3, the tablet-inverting mechanism which constitutes an essential part of the apparatus is shown as comprising a rotating member 15 having a number of radially formed recesses 26 which are equally spaced apart by radially-ribbed partition rings 27 around the periphery thereof and extend lengthwise of the rotating axle rod of the member 15. The member 15 is rotatably mounted in a cylindrical housing 28 having a peripheral flange 29 secured to a frame 30 of the machine by means of bolts-and-nuts 31.

The cylindrical housing 28 is provided with two conduit members 32 and 33 secured removably by screws 34 to its wall, the former extending close to the pulley 17 on the first stage and the latter extending close to the pulley 17^1 on the second stage. Each conduit member is substantially as wide as the belt of the conveyor and has formed therein a number of channels equal to the number of rows of tablets laid on the belt conveyor. Each of these channels, which are analogous to pigeon holes, has a width slightly greater and a height slightly lower than the diameter of a tablet so as to prevent the tablet from being inverted while on sliding through the channel. The conduit member 32 has its open end immediately adjacent the periphery of the pulley 17 where the tablets leave the belt 10 and fall into the channels of the conduit. As shown in Fig. 2, the free end of the conduit member 32 is curved in conformity with the peripheral contour of the pulley 17, so that each tablet falls snugly into the conduit. The conduit members 32 and 33 together comprise the aforementioned passageway 16.

The conduit member 33 extending radially opposite to and being substantially of the same construction as the first conduit member 32, is provided at an end immediately above the second stage pulley 17^1 with openings 35 communicating with the corresponding recesses 26 for transference of the tablets onto the second stage conveyor 10^1.

As seen in Fig. 3, the rotating member 15 is driven, through a sprocket arrangement

36, at exactly the same peripheral speed as those of the first and second stage pulleys 17, 17¹ and in the same direction as indicated by the arrow. Indicated at 37 and 38 are a screw and a key respectively which are adapted to secure the sprocket to the shaft of the rotating member 15. At 39 is a cylindrical cover secured by stud bolts 40 to the flange 29. In addition, a ball bearing 41 is provided for supporting the rotating member 15, and at 42 is a washer.

With this construction, a predetermined number of rows of tablets 100 may be electrostatically coated first on their one sides while passing under the coating atomizer 13 at the first stage and dried in contact with heat radiated from the infra-red device 14. The tablets having one of their surfaces coated further advance on the conveyor 10 until they fall by their own gravity off the periphery of the pulley 17 in clockwise motion and slide down the channels of the conduit member 32. The one-face coated tablets are then caught by the recesses or pigeon holes 26 of the rotating member 15, which may be configured conforming to each individual tablet, and are gradually reversed as they rotate with the rotor 15 half around the circumference of the cylindrical housing 28. Thus, each tablet is completely inverted by the time it is received into the channel of the conduit member 33 on the other side of the reversing device 15. The half-coated tablets thereby turned over are dropped through the openings 35 of the conduit member 33 and onto the second stage belt conveyor 10¹ and are subjected to coating on the remaining halves of the tablets in a manner similar to the first stage coating operation above described.

There may be provided a suitable receptacle 43 for storing the coated tablets as schematically illustrated in Fig. 1.

In one of the preferred forms of the invention, there may be provided reservoirs 20, 20¹ one at each stage of the coating unit which are filled with water containing a suitable chemical to clean the belts of the conveyors after each cycle of coating operation. For this purpose, there are provided brush rolls 21, 21¹ thereby more effectively removing the deposit on the belts and maintaining their surfaces flat and smooth for carrying tablets thereon in the subsequent cycle of operation.

It will be appreciated from the foregoing description that tablets or pills can be coated on both faces in a continuous mode of operation without interrupting the transport of tablets on the conveyors, and it is thus rendered possible according to the invention to permit of a quantity production of coated medicaments with minimum equipment costs and with ease of operation.

The washing bath 20 may be eliminated by the use of a roll of paper strip travelling on and with the conveyor 10 for transport of the tablets, so that the conveyor is held from direct contact with sprayed coating material. Furthermore, the pitch or spacing between adjoining recesses 26 around the periphery of the rotor 15 may be varied with the size or diameter of a tablet to be coated. In this manner, the apparatus may be used flexibly for a variety of sizes of tablets simply by changing the rotor 15.

WHAT WE CLAIM IS:—

1. Electrostatic tablet coating apparatus comprising an upper conveyor arranged to receive and carry uncoated tablets substantially equally spaced apart, and a lower conveyor driven synchronously with and mounted at a lower elevation than the first conveyor, there being one atomizer adapted to apply fine particles of a coating solution to one side of each tablet in a high potential electric field created by means of a grid connected to a source of high voltage, and another atomizer and a second grid adapted to coat the other side of the tablet electrostatically, a corresponding pair of infra-red dryers also being provided, in which the apparatus includes a tablet-inverting device comprising a substantially cylindrical rotor having a number of peripheral recesses adapted to receive tablets therein and being enclosed in a cylindrical housing which is interposed between the two conveyors, the rotor being arranged to rotate at a peripheral speed substantially the same as the linear speed of the conveyors and being in communication with a radial multi-channelled conduit leading from the discharge end of the upper conveyor so as to convey tablets therefrom, and with another substantially diametrically opposed radial multi-channelled conduit leading to the receiving end of the lower conveyor so as to convey tablets thereto.

2. Apparatus according to claim 1, in which the rotor is arranged to carry each tablet received in one of its peripheral recesses through an arc of substantially 180°.

3. Apparatus according to claim 1 or claim 2, in which the peripheral recesses in the rotor extend lengthwise of the rotor and are equally divided by ring members mounted on the periphery of the rotor thereby forming pigeonholes for reception of individual tablets, the number of these pigeonholes being equal to the number of chan-

nels provided in each of the conduit members.

4. Electrostatic tablet coating apparatus substantially as herein described and shown in the accompanying drawings.

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Abingdon: Printed for Her Majesty's Stationery Office, by Burgess & Son (Abingdon), Ltd.—1967
Published at The Patent Office, 25 Southampton Buildings, London, W.C.2,
from which copies may be obtained.

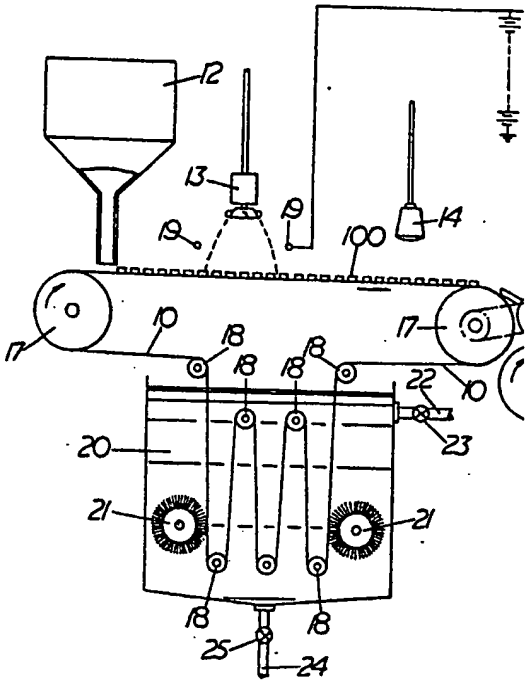
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FIG3

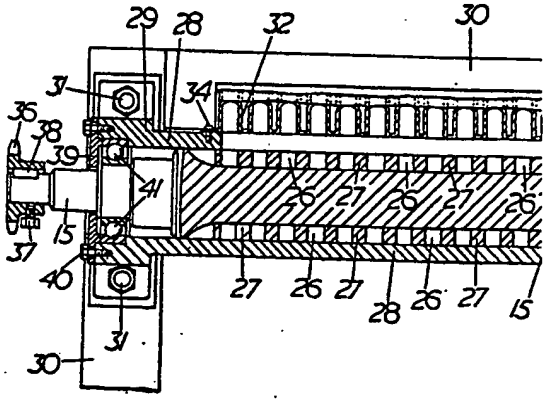
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FIG.1

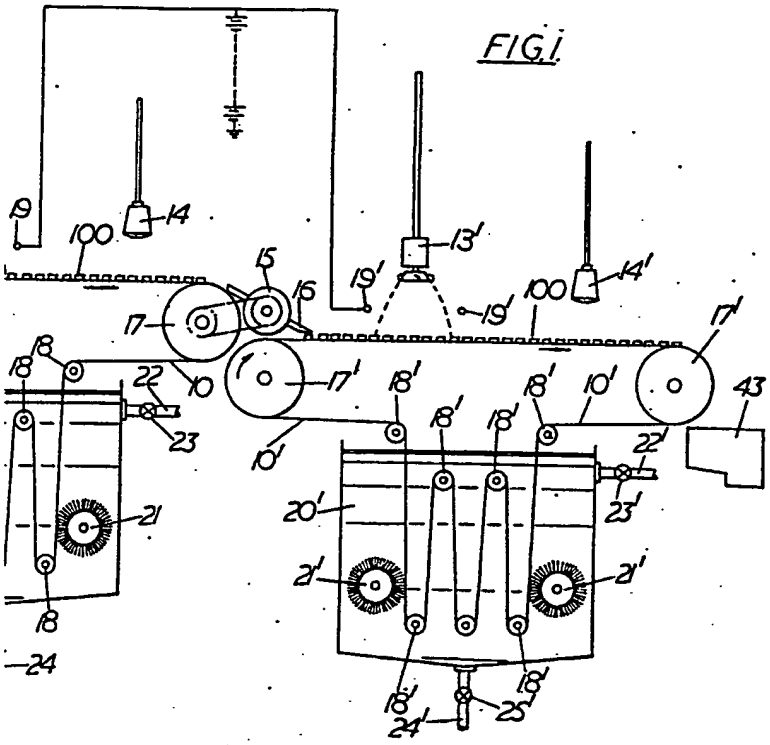

FIG.3

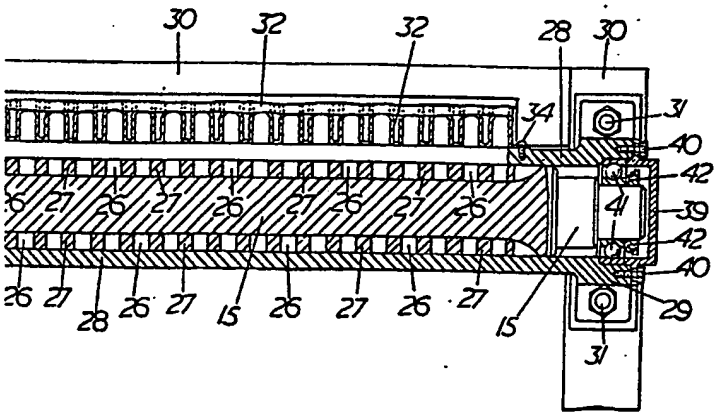

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FIG.1

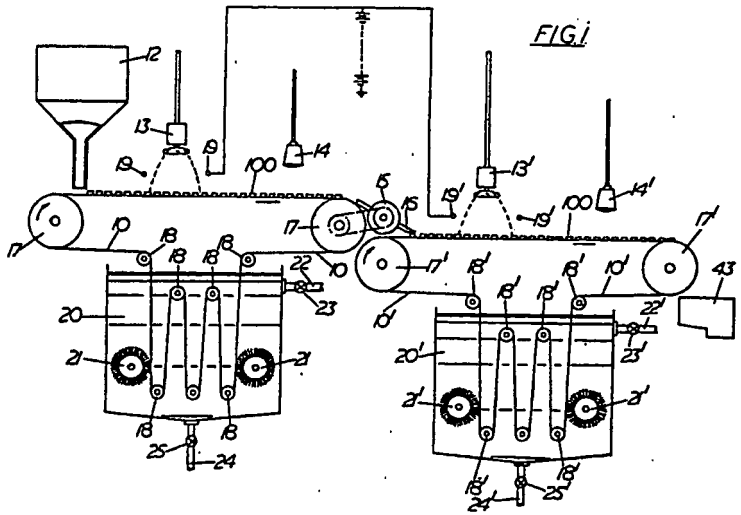

FIG.3

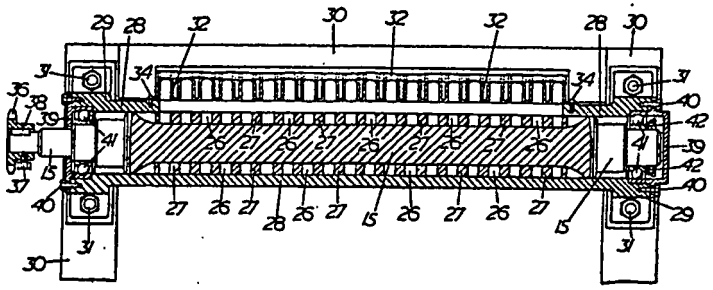

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FIG.2